



PRELIMINARY IDEAS ON 2<sup>nd</sup> GENERATION  $\nu$  EXPERIMENTS

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We have come to some preliminary conclusions regarding the characteristics of 2<sup>nd</sup> generation neutrino experiments. These will certainly be refined and no doubt in some cases changed in the coming months. However, it was felt worthwhile to make an attempt at this early stage to try to define a consensus opinion on some of the desired detector characteristics at this time. (We shall not make comments on the proposed improvements to existing neutrino experiments #1A and 21).

We shall discuss some of the physics objectives and detector characteristics to measure much more accurately high energy  $\nu$  and  $\bar{\nu}$  interactions with H, D and heavy targets with clean identification of both charged and neutral current events. This will require both improved statistics and increased resolution. These considerations will be given in qualitative terms and in addition be very brief.

Detector Characteristics

1. The useful mass of liquid target should be an order of magnitude times the useful mass of hydrogen in the existing 15' bubble chamber.
2. The study of  $\nu$  and  $\bar{\nu}$  interactions should involve both charged and neutral currents with a useful massive target an order of magnitude times the useful mass of the existing experiments #21 and 1A.
3. A high quality dichromatic beam is essential for the study of neutral currents.

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4. Recognizing that these experiments are of the greatest importance and will each last several years we strongly feel that these investigations with liquid and heavy targets should both be pursued vigorously.

5. The detector should have a high efficiency over the broadest range of  $x$  and  $y$ ; we feel that a system which combines target and magnetic analysis together meets this objective.

#### Liquid H and D Target Detector

We shall not mention many of the well known desirable characteristics but rather identify some of those that need more study.

1. To study neutral current events the energy and effective three momentum of the hadron jet must be measured as accurately as possible. This probably requires measurement of the momentum and angle of the hadrons (including neutrals) with high efficiency. To minimize interactions of members of the jet with the liquid target, thereby deteriorating the ability to measure the jet properties accurately, it is necessary to segment the liquid target and perform measurements on the individual charged hadrons as they traverse the liquid. We consider it desirable to determine the momenta of the hadrons using a magnetic field. It may be desirable to supplement this with the calorimetric technique.

2. The detector must measure the energy of energetic gamma rays from  $\pi^0$ 's.

3. The requirements for  $K^0$  and neutron detection must be examined.

4. The detector proposed in Experiment #256 (Osborne et al) appears to meet many of the qualitative requirements that we envision

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are necessary. However, much further work, principally in Monte Carlo studies are required to answer many quantitative questions in more detail.

#### Massive Target Detector

1. Again, to study neutral current events in detail, it is necessary to measure the mean angle and the energy of the hadron shower and desirable to measure the invariant mass of the hadron jet distribution. These requirements suggest dispersing the target material in the beam direction. These target plates need to be thin and in addition magnetic analysis needs to be performed throughout the target volume.

2. Thus the detector needs to be extremely massive and distributed with reduced density in the beam direction. Many planes of detectors with high spatial accuracy are required. In addition, these detectors are required to respond linearly in pulse height to hadron energies.

3. The above requirements demand a quantum jump in detector capabilities, taxing the electronics developments of the past decade. The type of detectors proposed in experiment #316 (D.Nygren) appears to meet the requirements that we have identified. We feel that work should begin immediately to construct and test a prototype of this kind of detector.

4. Monte Carlo estimates or better still experimental measurements of the shower characteristics as a function of the degree of dilution of the density of the target are required.